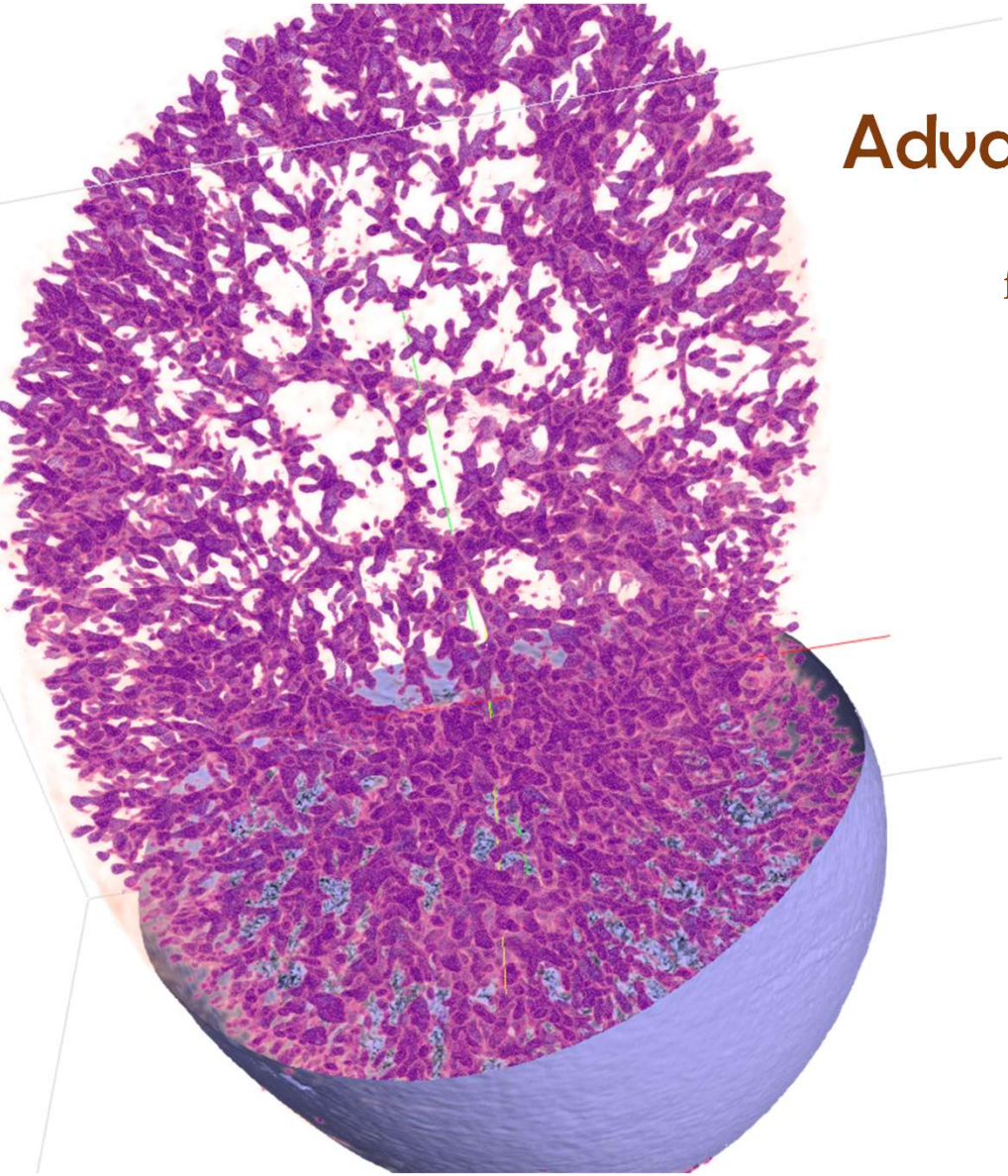


Advancing renal imaging biomarkers

Synchrotron X-ray micro-CT imaging for resolving complex 3D structural changes in the kidney

Anja Schmidt-Christensen, Associate Professor

Diabetic complications group

Lund University diabetes Center (LUDC)

Department of Clinical Sciences, Malmö

anja.schmidt-christensen@med.lu.se

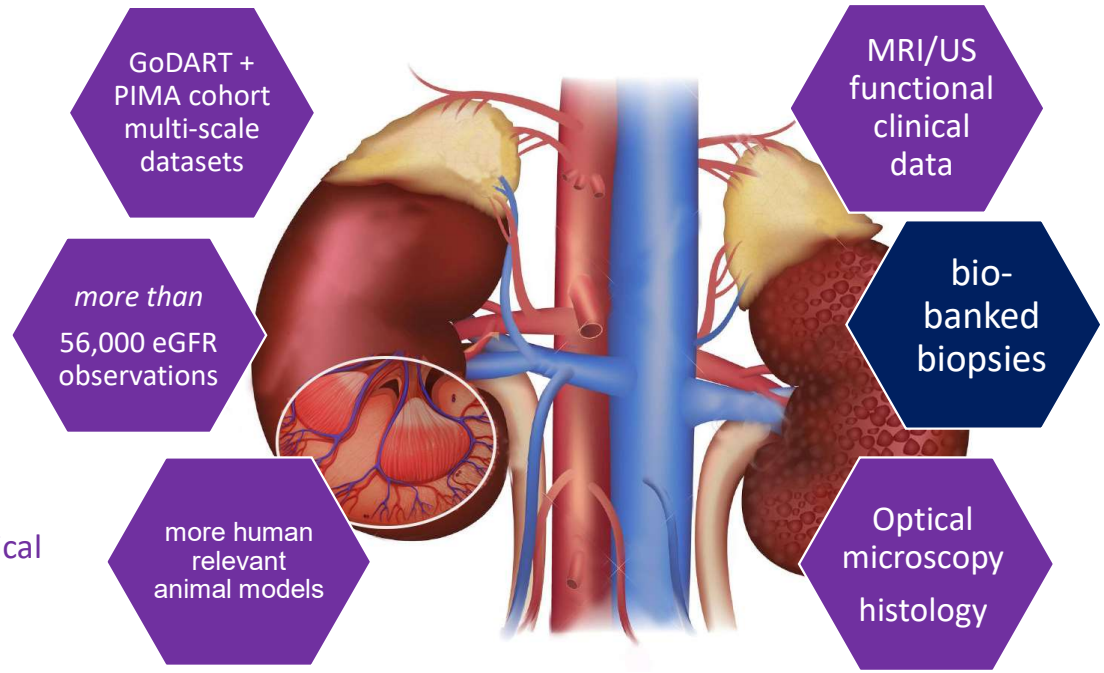
HALOS online symposium – 31 jan 2022

What initiates and drives the *progression* of Diabetic Kidney Disease?

Molecular profiling

Immune regulation

Pathophysiological representation



BEAt DKD

What initiates and drives the *progression* of Diabetic Kidney Disease?

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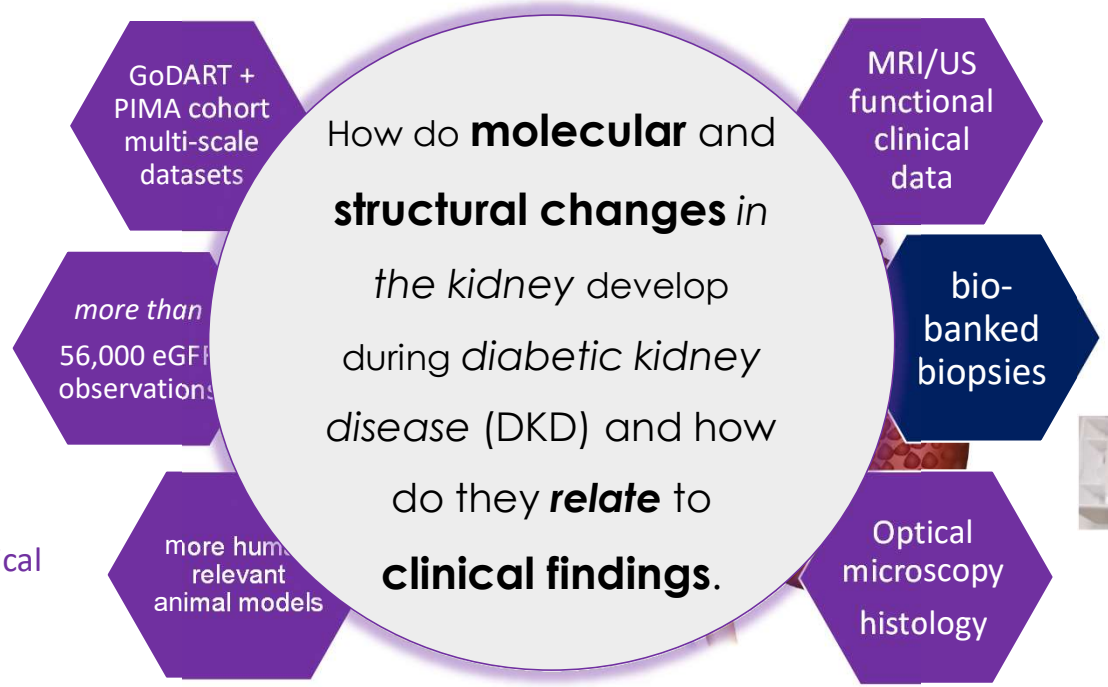
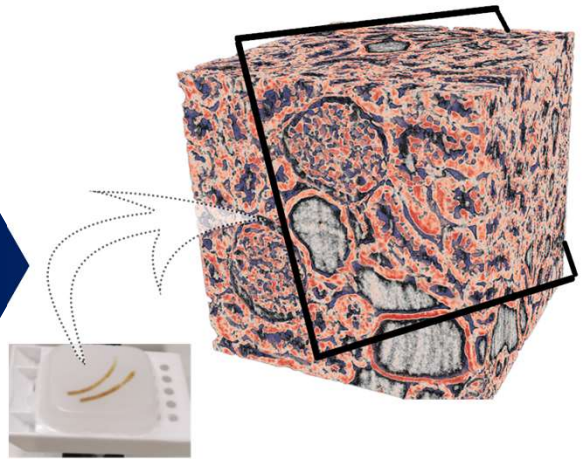


Synchrotron X-ray tomography

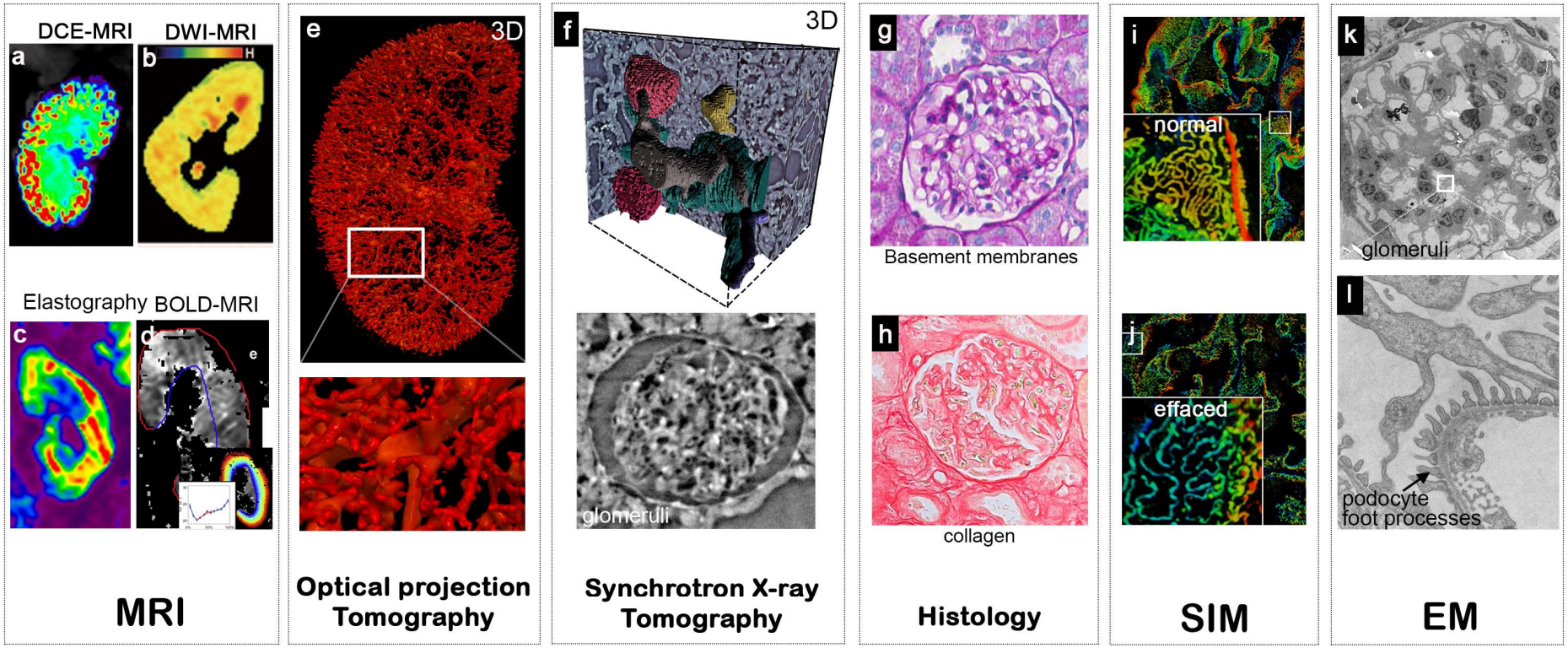


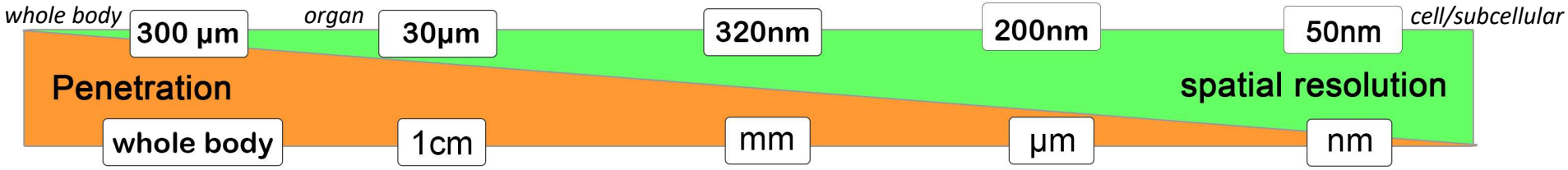
BEAt DKD

LUND UNIVERSITY

LU Innovation
THE LINK BETWEEN ACADEMIA AND BUSINESS

Renal imaging modalities differ in length (resolution) and timescales

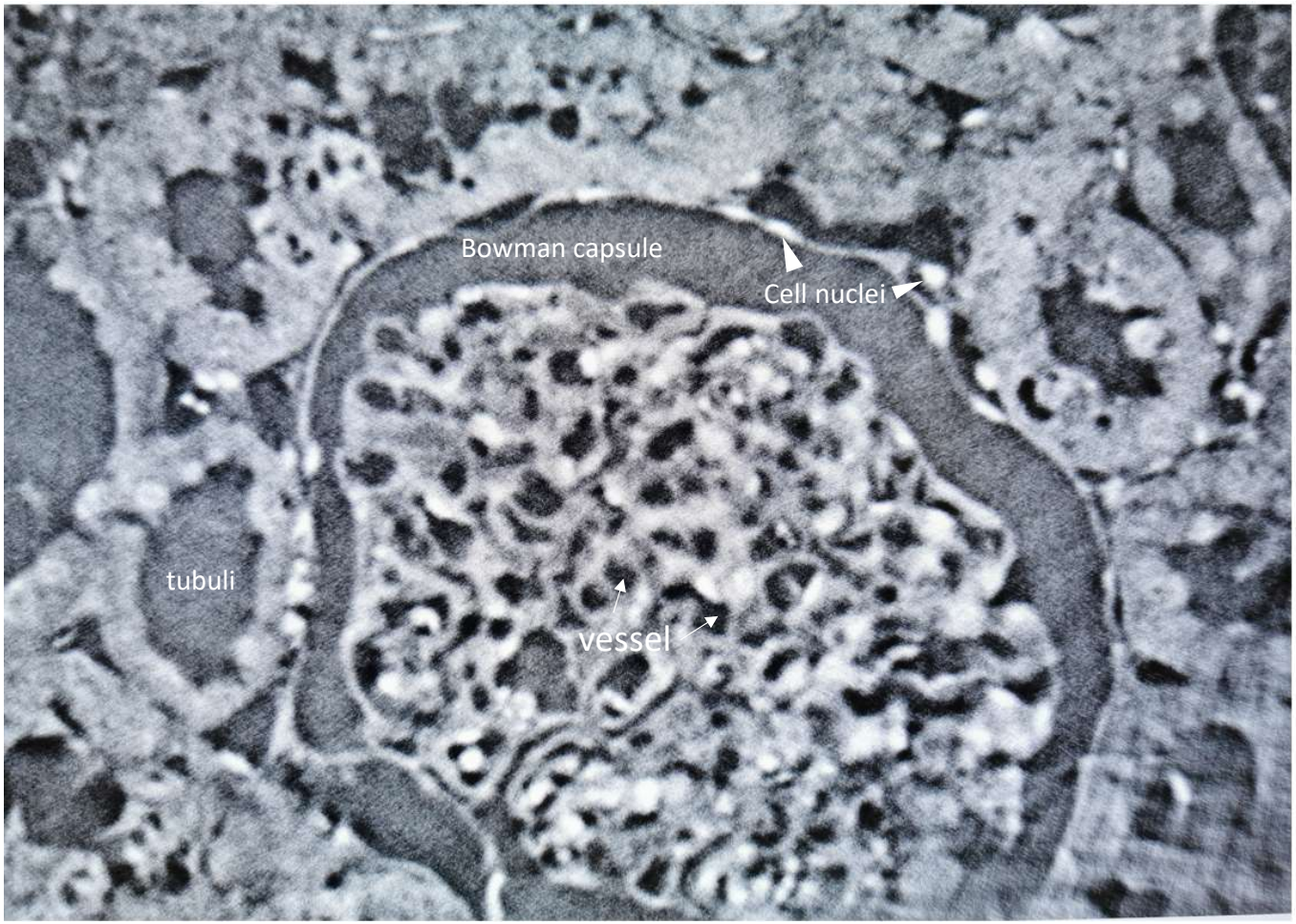


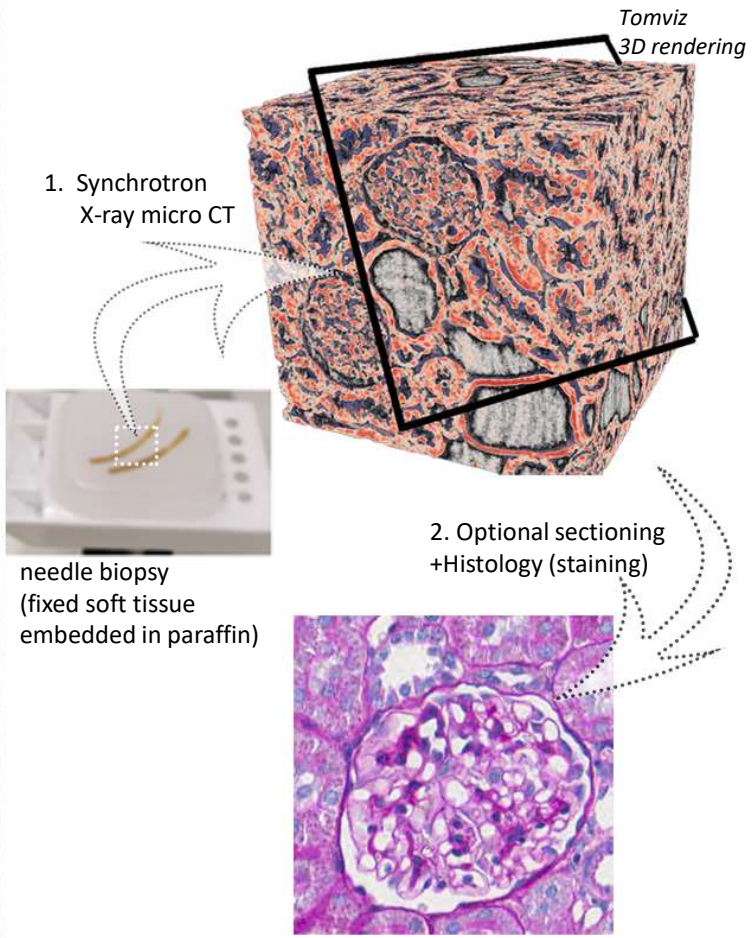


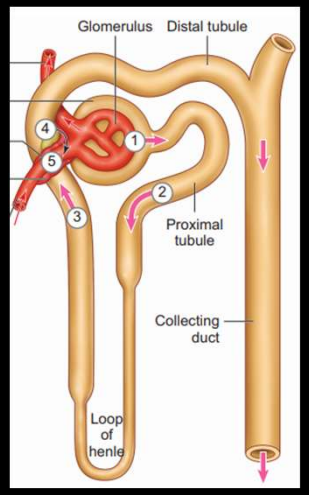
Gooding, K.M. *BMC Nephrol* **21,** 242 (2020); Su, CH. *et al. Sci Rep* **11,** 1909 (2021); Siegerist, F *et al. Sci Rep* **7,** 11473 (2017)

high-resolution Synchrotron x-ray Imaging

Powerful synchrotron light, traveling at nearly the speed of light, allows a deep look into biological tissues and can reveal high-resolution **structural secrets** in paraffin-embedded biopsies <u>without sample destruction</u>

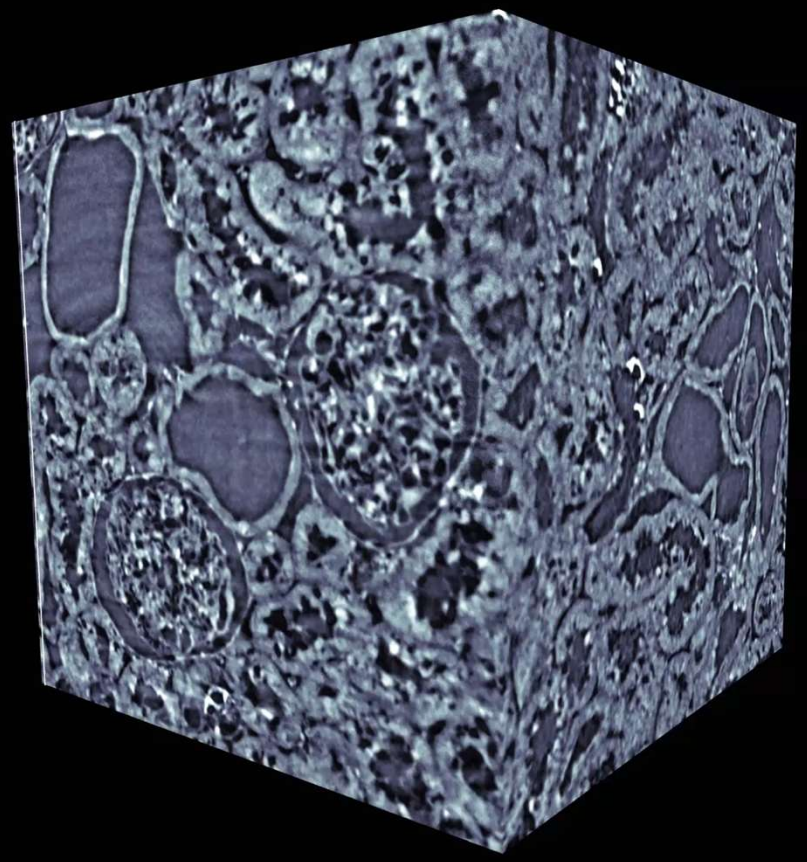






Synchrotron X-ray micro-CT imaging for resolving complex 3D structural changes in the kidney:

a missing piece of information needed to understand and potentially predict DKD progression

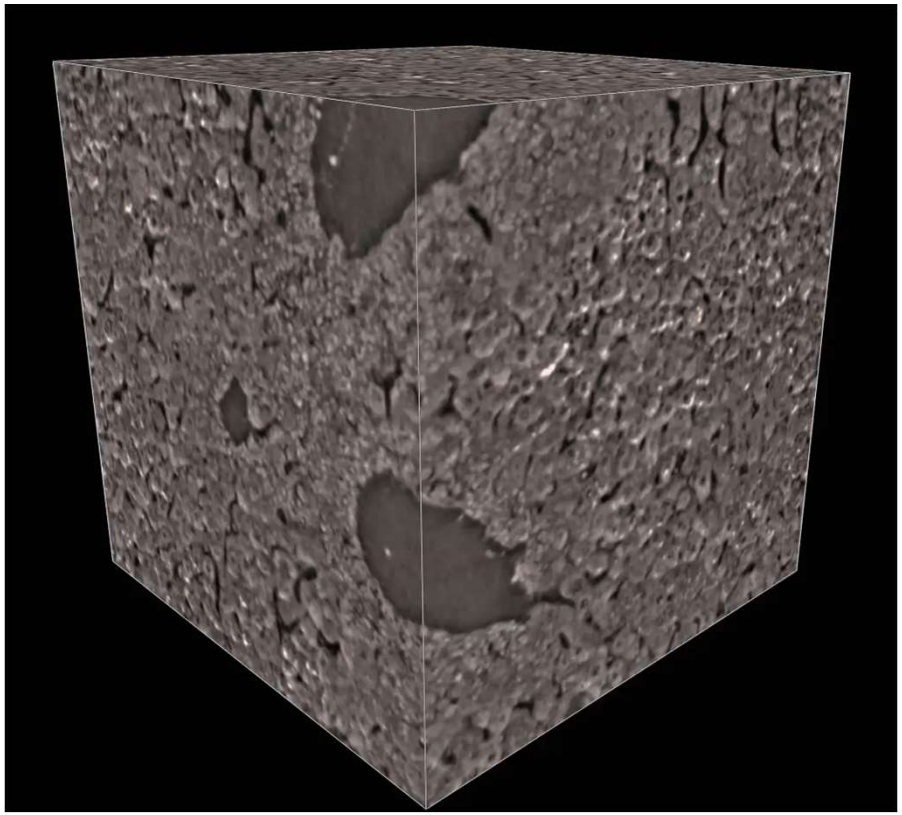


BBDR.cg-lepr.cp rat kidney
Scanned at Tomcat beamline, SLS
voxel size: 0.32µm
Displayed: 380x380x380µm

Image analysis using automated machine learning approach
Example from fibrotic liver

Dan Holmberg, Julia Nilsson

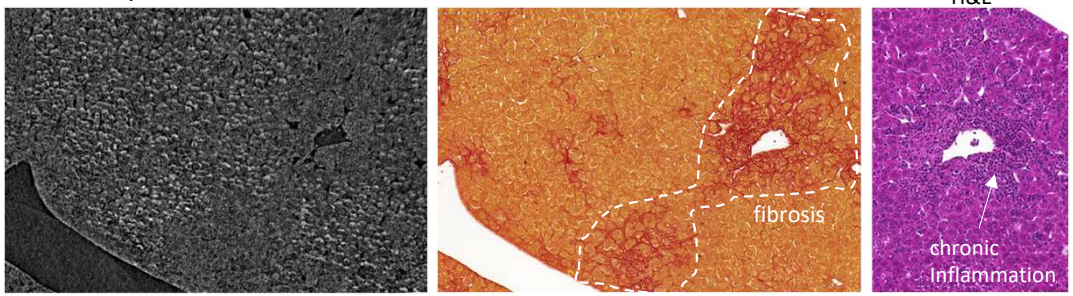
Rajmund Mokso



Synchrotron micro CT

Picro Sirius Red stain

H&E



RESEARCH ARTICLE

A New Mouse Model That Spontaneously Develops Chronic Liver Inflammation and Fibrosis

Nina Fransén-Pettersson[1,2], Nadia Duarte[3,4], Julia Nilsson[1], Marie Lundholm[3], Sofia Mayans[3], Åsa Larefalk[3], Tine D. Hannibal[1,2], Lisbeth Hansen[1,2], Anja Schmidt-Christensen[1], Fredrik Ivars[1], Susanna Cardell[5], Richard Palmqvist[6], Björn Rozell[7], Dan Holmberg[1,2,3]*

OPEN

NKT cells promote both type 1 and type 2 inflammatory responses in a mouse model of liver fibrosis

Julia Nilsson[1,2], Maria Hörnberg[2], Anja Schmidt-Christensen[1], Kajsa Linde[2], Maria Nilsson[1], Marine Carlus[3], Saskia F. Erttmann[4], Sofia Mayans[2] & Dan Holmberg[1,2]

Interreg
Öresund-Kattegat-Skagerrak
European Regional Development Fund
EUROPEAN UNION
ESS & MAX IV:
Cross Border
Science and Society
MAX4ESSFUN

Image analysis using automated machine learning approach
Example from fibrotic liver

Dan Holmberg, Julia Nilsson

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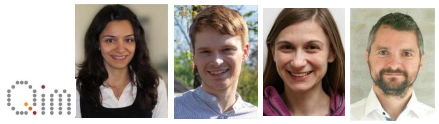
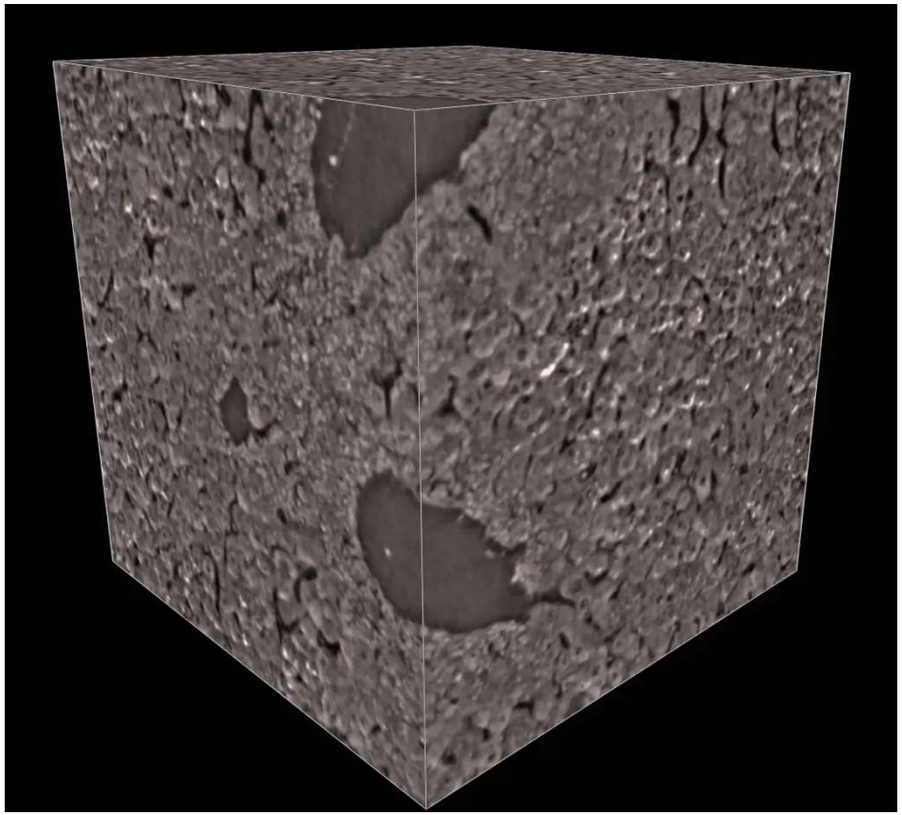
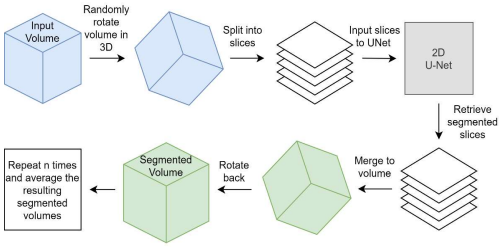
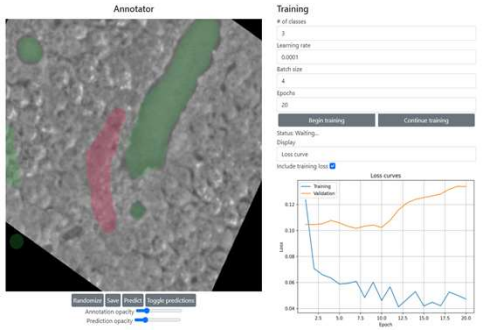




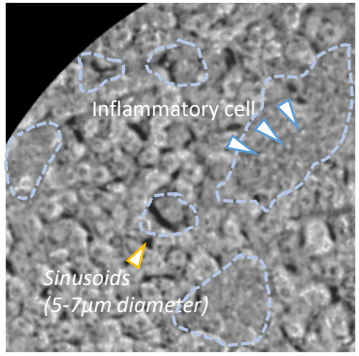
Supervised machine learning approach using U-net



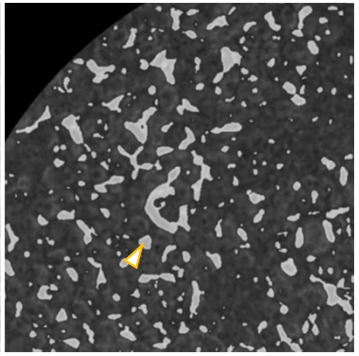
Training user surface



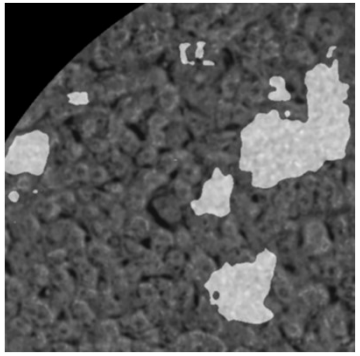
Raw data



Vessels (sinusoids)



Fibrotic (sick)



Phenotyping of the rat model
Kidney project

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Maria F. Gomez
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Anna-Maria Dutius Andersson
Abrar Ahmad
Monika Dudenhöffer-Pfeifer
Lina Åkesson
Anna V. Zetterqvist,
Lisa M. Berglund
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LUDC
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Nils Wierup
Martin Johansson
Linda Faxius
Anita Ramelius
Zealand Pharma
Mark Skarsfeldt
AstraZeneca
Ann-Cathrine Jönsson-Rylander

its important to study disease in its complexity within the whole tissue

Synchrotron imaging/Analysis

MAX IV lab /DTU
Rajmund Mokso

TOMCAT, Swiss light source
Christian M. Schlepütz
Arttu Miettinen

Heart project
University of Turku
Antti Saraste
Jenni Virta

Liver project
LUDC
Dan Holmberg
Julia Nilsson
InfiCure Bio
Maria Hörnberg
SUS
Kristina Önnerhag

DTU /QIM
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Behnaz Pirzamanbein

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